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UNITED STATES
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BUREAU OF MINES
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INFORMATION CIRCULAR

STANDARDIZED CONSTRUCTION OF MINE VENTILATING DOORS

BY

J. C. HARTLEY AND A. C. MOSCHETTI

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STANDARDIZED CONSTRUCTION OF MINE VENTILATING DOORS 1/

By J. C. Hartley 2/ and A. C. Moschetti 3/

Introduction

The most important single operation in mining is the ventilation of underground areas in a manner conducive to the health and safety of employees. Adequate volumes of pure air must be supplied at the working faces, along the haulageways, and wherever men work, so as to dilute and carry away the methane liberated from the coal and adjoining strata, noxious gases evolved by the use of explosives, and the carbon dioxide exhaled by men and formed by oxidation of carbonaceous material, as well as any other gases, and also dusts which may be found in mine workings. A sufficient quantity of air must also sweep abandoned or worked-out areas of the mine to prevent the accumulation of gases, where sealing methods are not utilized to isolate old workings.

Air, in a quantity adequate to meet the needs of the particular mine to which it is applied, is necessary, and supplying it can be made very expensive through failure to observe good practices in its direction and apportionment. Leaky stoppings, doors, and overcasts rob the working faces of air and add to the ventilating cost by burdening the fans with fugitive air.

Careful construction and maintenance will minimize the leakage of air through stoppings and overcasts, but some leakage is nearly always present at doors. For this reason and the fact that many explosions have resulted from doors left open, the indiscriminate use of doors, in places where stoppings and overcasts can be used, should be discouraged. One faulty door which permits excessive escape of air may add so greatly to the ventilating expense that the initial saving in the construction of the door is false economy. Nevertheless, many doors are in use along haulage roads where nothing else will suffice, therefore, the construction of the door and doorframe merits careful consideration, based upon efficiency rather than initial cost.

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote adknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7280."

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During a recent inspection of the South Wilkes-Barre colliery of th Glen Alden Coal Co., especial note was taken of the construction of venti- lating doors in use along haulageways. The installations are substantial, are as nearly airtight as is feasible to construct them and permit changi the door readily if it is desired to reverse the air current in a section o a split.

Acknowledgments

The standardization of doors as described in this paper was first d by William L. Davis, superintendent at South Wilkes-Barre colliery, and their operation has proved so efficient and economical that the Glen Alde Coal Co. now has them installed at numerous other operations.

Davis is to be commended for the work he has done in improving t ventilating facilities at his mine; and the authors are indebted to him for furnishing the data herein submitted and for many other courtesies tend in the course of the inspection of his mine. The courtesy of the Glen Al Coal Co. in connection with the release of the data in this publication is gratefully acknowledged.

Review of Mining Conditions

At South Wilkes-Barre colliery, 10 veins of coal are being mined, which the pitches range from flat to vertical, between points near the ou crop of upper veins and the bottom of the basin in the lowest vein, about 1,500 feet below the surface. Hoisting shafts are 1,030 and 1,408 feet in depth, with landings 698, 1,030, and 1,408 feet below the surface.

Gangways along the strike are developed in the veins at many leve the coal being transported to the levels upon which the shaft landings ar located through numerous slopes, planes, and rock tunnels which inter- connect all of the veins.

Ventilation is induced by two fans, operated exhausting, each of w is handling practically its capacity of 400,000 cubic feet of air a minute water-gage pressures of 2-3/4 and 3-1/4 inches, respectively. The ven lating system, which embraces some 40 splits, is exceedingly complex; and since the mine is liberating more than 3,000,000 cubic feet of meth in 24 hours, every consideration must be given to maintaining adequate volumes of air in the splits and at the face workings and minimizing the handling of fugitive air at the fans.

Sufficient volumes of air are supplied at the faces by the use of concrete stoppings, air bridges, and substantial main doors, which are

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erected in pairs and sometimes in groups of three or more to form air locks. At the working sections, wooden doors on the gangway between each chamber, wooden stoppings in all chamber crosscuts except the last, and wooden line brattices cause the ventilating currents to traverse the active working faces. Main doors, their substantial construction, and the manner in which they are installed are discussed in this circular.

Construction of Doors

To construct the doorframe, forms are so built as to leave an opening 3 feet 9 inches in width and 6 feet above the rail in height. The thickness is 14 inches at the top of the rail and 10 inches at a point 6 feet 5 inches above the rail, giving a batter of 5/16 inch to the foot on each face of the frame. A 4- by 5-inch block is placed on edge in the top of the form in such a manner as to leave an opening in the finished doorframe for the trolley wire. Forms are also put in place for the doorsil, which is brought to a point 3 inches above the rail; clearance for the wheel treads and flanges is made with a trowel after the intital "set" of the concrete.

On each side of the doorframe, three pieces of 1-1/4-inch pipe, cut to suitable lengths, are inserted through the form, the upper pipes being 4 inches from the edge of the frame and 5 feet 2 inches above the rail. Additional pitch to make the door close when released from the open position is gained by placing the bottom pipes 5-1/2 inches from the edge of the frame. These bottom pipes are 10 inches above the level of the rail, and the center pipes are equally spaced and in line with those at the top and bottom.

A 20-inch length of 1-1/4-inch pipe is also placed through the form to be used later, with the necessary fittings, to support the trolley wire. The pipe is centered over the filler block, which leaves the opening for the trolley wire, 9-5/8 inches above the top of the doorframe.

Concrete to fill the form is mixed by hand in an approximate 1-to-3 proportion. If broken rock is at hand, it may be used to add bulk and shorten the work.

After the forms are "stripped", the doorframe is "pointed up" with a trowel, especial attention being given to sealing at the rib and roof lines.

Hinge bolts, prepared in the shop from 1-inch round iron, have one end threaded for a nut, and a 5/8- by 2-1/2-inch hinge pin is welded to the other end. The hinge bolts are placed through the pipes on the side of the face from which the door is to be hung. The three pipes not in use at the other edge of the doorframe are plugged with cement when the pointing is done.

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The door is 6 feet 2 inches by 9 feet 3 inches and is constructed of two thicknesses of 1-inch unfinished lumber, with roofing paper betwee the two plies to prevent leakage. Three 3/8- by 2- by 67-inch hinges are bolted to the door at the proper points to engage the hinge pins, after whic the door may be hung to complete the installation. The space between the top of the rail and the bottom of the door is limited to 1 inch, which is closed by tacking a strip, containing several thicknesses of brattice cloth, along the bottom edge of the door. The brattice cloth, if properly applied, will not fold under and foul the door against the rail, as the batter of the doorframe causes the door to rise as it is opened.

Figure 1 shows the elevation, plan view, and details for the construction of this standard door.

The trolley wire is held rigid in the center of the opening left for its passage by suitable fittings, as shown in figure 1. Attention must be given to the position of the trolley wire for at least 10 feet on each side of the door so it will be out of the way of the door as it is swung open. This necessity for raising the wire requires it to be at least 6-1/2 feet above the rail; therefore, no attention need be given to which side of the track the wire is on, if other conditions warrant having the door open fro what is generally known as the "wrong" side of the gangway.

In a haulageway of the normal 8- by 12-foot cross section, 1-1/2 cubic yards of concrete will be required for the doorframe. It was state that the job is completed by two workmen in three shifts.

Conclusion

Use has shown that the doorframes are practically indestructible from derailments of cars and locomotives; they offer protection to the door attendant or the brakeman; and when used in pairs to form air lock they reduce leakage to a minimum. Several explosions have resulted fr ignitions of accumulations of gas between air-lock ddors. In gassy mine enough air leakage should be permitted to prevent accumulation of gas between air-lock doors. In anthracite mines, where years pass between original development and the recovery of pillars, frames built during th advance mining may be useful when ventilation must be restored to complete the mining. One of the most important features is that doors are interchangeable; in case of destruction of a door another may be procure and quickly put in place, this being of vital importance at least in some places.

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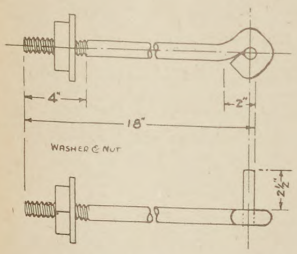
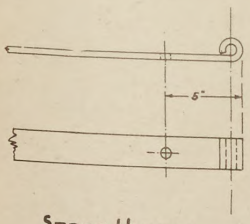
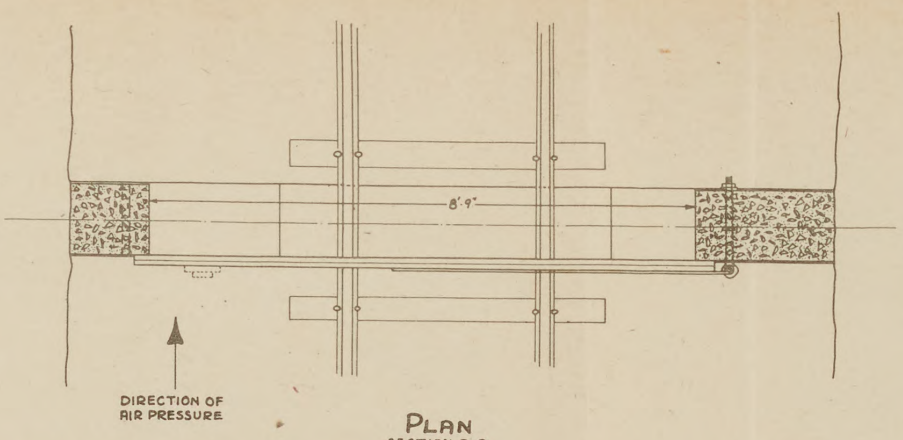


HINGE PINS
FORGED FROM 1" ROUND IRON WITH ⅝" PIN-WELDED



STRAP HINGES
END FORGED TO RECEIVE ⅝" PIN
⅜"x2" FLAT-5'-7" LONG
5-⅝" HOLES-15" ON CENTER

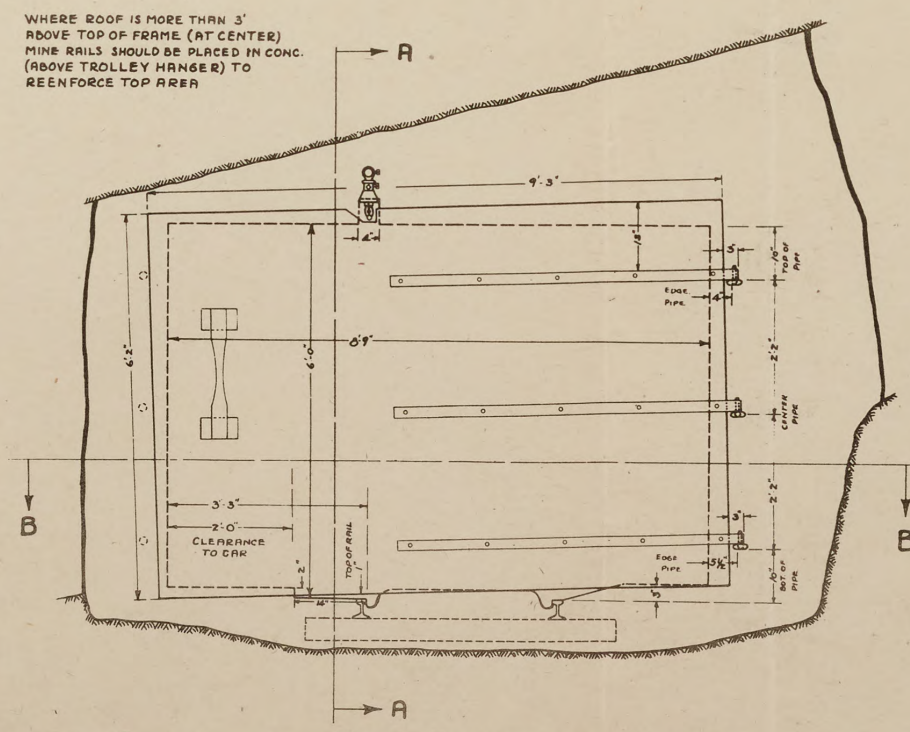


PLAN
SECTION B-B

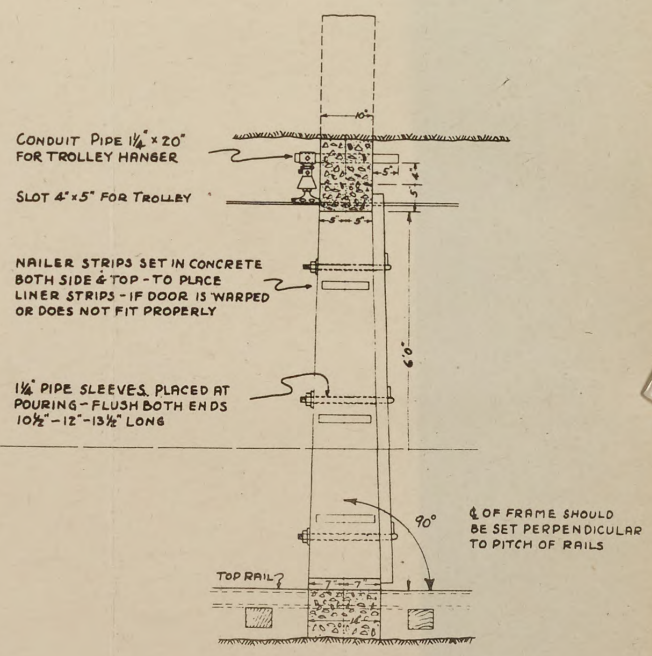
DOOR FRAME SHOULD BE SET SQUARE WITH OPENING

DOOR MADE OF 2 THICKNESSES OF 1"x12" BRATTICE BOARDS FRONT FACE IN DIRECTION OF STRAPS - BACK LAYER UP & DOWN

WHERE ROOF IS MORE THAN 3' ABOVE TOP OF FRAME (AT CENTER) MINE RAILS SHOULD BE PLACED IN CONC. (ABOVE TROLLEY HANGER) TO REENFORCE TOP AREA



FRONT ELEVATION
SCALE 1"=12"


CONDUIT PIPE 1¼" x 20" FOR TROLLEY HANGER
SLOT 4"x5" FOR TROLLEY
NAILER STRIPS SET IN CONCRETE BOTH SIDE & TOP - TO PLACE LINER STRIPS - IF DOOR IS WARPED OR DOES NOT FIT PROPERLY
1¼" PIPE SLEEVES, PLACED AT POURING - FLUSH BOTH ENDS 10½"-12"-13½" LONG
10"
5"
6'-0"
90°
TOP RAIL
℄ OF FRAME SHOULD BE SET PERPENDICULAR TO PITCH OF RAILS

SECTION A-A

DOOR TO BE SET 1" ABOVE RAIL THEN STRAPS PLACED AND FASTENED

CANVAS OR BRATTICE CLOTH NAILED TO BOTTOM OF DOOR TO PREVENT LEAKAGE.

Figure 1.— Standard reversible mine door at South Wilkes-Barre colliery, Glen Alden Coal Co.

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